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Administrative Report

GEAR AND BEHAVIOUR COMMITTEE

P.J.G. Carrothers, Chairman

Belgium

(G. Vanden Broucke)

The study of the double beam trawl was continued and comparative fishing experiments were conducted on board a stern-beam trawler. Adjustments of mesh size in the upper net prevented tearing and reduced the load. The use of a built-in double codend enhanced the catch capacity and simplified the discharge of the catches from the codend. The results were on the whole very satisfactory.

The investigations on the semi-pelagic trawls included trials both with one-boat and with pair trawls. A one-boat semi-pelagic net with two leg systems was further tested on a side trawler and on a beam-stern trawler. The rigging of the net was designed to obtain a large horizontal spread with relatively small boards by using the distance between the tops of the booms in horizontal position.

A semi-pelagic pair trawl for the coastal fishery was developed for fishing on rough grounds with pinnacles. In the lower belly, the netting was substituted by nylon rope fixed lengthwise in the trawl. It appeared, however, that the risk of the net being torn is still far too great.

Warp tension measurements were carried out to improve the Danish pair trawl fishery still further. An identical force exerted by both vessels on the net increases the catch capacity of the fishing gear and reduces damage and loss of fishing gear.

Five series of experiments were conducted with pelagic pair trawls aboard middle-water trawlers and the behaviour of the nets in relation to ballasting, the number of floats, and the speed was investigated. The experiments showed that small variations in speed have practically no effect on the height of the headline. Only the groundrope changes its position. The height of the whole net is changed only by varying the number of floats or weights. Generally, the net tore only while the vessel was turning. It is thus necessary to check the profile of the sea bed regularly on the echo-sounder.

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A compact pulse generator for electrical fishing was developed and submitted to laboratory tests.

By means of log-books kept by fishermen, the sole and plaice catches made by a beam trawler fishing in the Liverpool Bay were analysed.

Acoustical measurements were carried out on the research vessel to determine the acoustical field generated by different nets (shrimp trawl, bottom trawl, semi-pelagic net). The trawl rigging (groundrope, number of floats) as well as the hydrophone location on the headline, on the upper panel of the net or on the legs, were modified.

Concerning multi-purpose vessels, classical side trawlers were converted to stern trawlers with net-hauling drum and netsonde.

Various yarns and netting material were tested for breaking load, knot and mesh breaking load, mesh size, etc., mainly at the request of the industries concerned.

The wear of netting in different parts of a beam trawl for sole was examined.

An automatic feeding system for the rinsing and sorting machine for shrimps was further investigated.

Plans for future work include:

- further experiments with a double beam trawl on middle-water beam trawlers.
- the use of a compact pulse generator in electrical fishing for soles and shrimps.
- further development of multi-purpose vessels.
- study of the behaviour of pelagic and semi-pelagic nets.
- investigations in the field of netting yarns and netting.

#### Canada

(P.J.G. Carrothers)

The most significant change in fish-capture research and development is the amalgamation into the Technology Branch of the Federal Fisheries and Marine Service in Halifax, N.S., of the Industrial Development Operations from Ottawa and the Fishing Gear Research from St. Andrews, N.B. This new group has a national mandate despite its place in the regional organization and, although its main effort will be directed toward the primary fishing industry, it will also address fish-capture technology problems for resource management.

Pending reorganization, no new projects were undertaken during 1975, although good progress was made in projects already under way. The data-extension phase of the groundfish-trawl engineering study has revealed a good linear dependence of trawl-net drag on hydrodynamic pressure, with clear separation of hydrodynamic and ground-friction components of drag. Also, functional dependence of other variables of shape and load on hydrodynamic pressure is demonstrated. The computerized echo-counting project for assessing fish stocks is progressing as a tri-laboratory cooperative effort with components in Dartmouth, St. Andrews and St. John's. In Dartmouth, hardware developments include time-varied gain and sea-bed discrimination for groundfish, and software improvement for processing counts. In St. Andrews, echo strengths are being studied as a means for direct calibration, and survey design has been given attention. In St. John's, prime interest is in an integrator for capelin estimates. Also in St. Andrews, noise generated by an oil rig was studied in relation to the hearing ability of fish.

At the Pacific coast, high-frequency echo sounder and midwater trawl were used concurrently in a lake study of pelagic juvenile salmon, and net efficiencies were observed to range from 100% for overcast sky and dark moon to 6.4% for clear sky and full moon. The methods were complementary for population estimates. Adult herring populations are assessed from egg deposition in the previous year and new recruits are assessed from their proportions in initial catches. Distribution and abundance of herring, hake and pollock are by digital echo integration, and estimates of target strength in situ of herring, hake, pollock and dogfish are planned for 1976. A technique has been developed to examine contagious distribution of zooplankton, using a new plankton pump for sampling while under way and a modified Longhurst-Hardy plankton recorder.

Stern-seine trials are continuing on an 18-m vessel, using low-stretch headline and 0.8-m mesh in the wings, and there are plans for a jet-propelled skiff. The 50-m, triple-parallel, stern trawler continues to fish commercially with minor improvements to the door-handling system. There are plans to test the value of the articulated gallows-gantry on this vessel for fishing in ice. The diamond-type, high-lift bottom trawl has been given limited trials and the footrope-handling problem is under control. This gear can fish on rougher grounds than can the usual bottom trawl, and it still looks promising for round fish. Further trials are planned in cooperation with the Province of Quebec. A trial planned for off-bottom trawls involves selective gear for shrimp to avoid by-catch of juvenile ocean perch. Improved acoustic fish-finding methods are required.

A small group in the Faculty of Engineering, Memorial University of Newfoundland, St. John's, has been working under a research contract to complete development of a locally invented, line-trawl, baiting device as an inexpensive facility for inshore boats. A prototype has been constructed and preliminary sea trials undertaken.

Denmark

(K. Popp Madsen)

The following investigations were continued in 1975:

1. mesh selection experiments on cod with Nymplex 50 - 3/20 in the Baltic and the Sound.
2. catch of cod and flatfish in bottom trawl in relation to salinity and oxygen content near the bottom in the Sound.
3. the catchability of Norway lobster has been related to oxygen content and temperature near the bottom in the eastern Kattegat.

Finland

(Veikko Sjöblom)

No gear and behaviour work conducted in 1975.

France

(Marcel Portier)

Chaluts, chalutage

L'étude des engins et leur adaptation au comportement des espèces et à la nature des fonds a porté principalement sur le développement des chaluts de fond et semi-pélagiques à 4 faces, ainsi que sur le dessin d'un nombre important de chaluts pélagiques à un ou deux bateaux, comportant des grandes mailles à l'entêteure, en particulier pour la pêche artisanale (bateaux de 150 à 500 CV).

Le modèle de chalut semi-pélagique à 4 faces a subi une modification importante de sa face inférieure destinée à le rendre plus apte à la pêche des poissons de fond et à réduire les avaries sur les fonds durs ou sales. Il comporte des mailles de 400 mm ou 800 mm (étirées) à l'entêteure et il est utilisé principalement en France avec des panneaux de fond et un gréement à fourches; il est, par contre, employé dans certaines pêcheries par des navires étrangers, avec des panneaux hydrodynamiques selon la technique du chalutage contrôlé qui implique l'emploi constant du sondeur de corde de dos.

Les chaluts pélagiques à un ou deux bateaux ont généralement des mailles de 800 mm étirées à l'entêteure. Des essais satisfaisants ont été effectués avec des mailles de 1 200 mm et 1 600 mm pour un chalut-boeuf.

On a poursuivi l'allongement des chaluts, ce qui s'est toujours traduit par une amélioration de la capture. Si les chalutiers de moyenne puissance pratiquant la pêche pélagique du hareng



et du maquereau remorquent généralement leur chalut à des vitesses de 3,7 à 4,2 noeuds, on s'est aperçu par contre que, pour la capture de certaines espèces pélagiques telle la sardine, des vitesses de traine de 4 à 5 noeuds minimum étaient nécessaires. Aussi des trains de pêche (ensemble panneaux - chaluts) ont-ils été adaptés à la force motrice des navires pour être remorqués à des vitesses égales ou supérieures à 5 noeuds.

Parmi les espèces qui sont exploitées en chalutage pélagique, citons outre les poissons bleus, hareng, maquereau, sprat, anchois, sardine, des pêches occasionnelles mais de plus en plus fréquentes de morue, merlan, lieu noir, lieu jaune, dorade, mullet, bar.

Enfin, signalons que des chercheurs français et allemands ont collaboré à une expérience de pêche pélagique du krill, au large des Açores, à bord du Walter Herwig et d'un chalutier de pêche artisanale d'un port de Bretagne sud.

En ce qui concerne le chalutage strictement benthique, on peut noter que les chalutiers de pêche industrielle emploient, dans la majeure partie des cas, des chaluts de fond traditionnels comportant des mailles de 120 ou 140 mm à l'entêteure. Ce n'est qu'exceptionnellement qu'ils utilisent des chaluts de fond à grande ouverture verticale.

Par contre, ces chaluts de fond à 2 faces à grande ouverture verticale et le gréement à fourches sont très répandus parmi les bateaux de 100 à 800 CV.

Le textile le plus utilisé pour la construction des chaluts est le polyamide - en particulier les poches sont toujours réalisées avec ce matériau.

### Sennes à thon

Depuis 3 ans, maintenant, nous effectuons des mesures sur les sennes équipant les nouveaux thoniers-senneurs lorsque ceux-ci effectuent leurs essais au large des côtes bretonnes. Il s'agit, à l'aide d'un bathykymographe et de plusieurs tubes de Kelvin, de mesures de vitesse de plongée des sennes et de tenue de la ralingue inférieure pendant le virage de la coulisse. Les profondeurs atteintes par les sennes sont de plus en plus importantes : environ 100 m, ceci est dû à une augmentation de la hauteur des filets en nombre de mailles ainsi qu'à un changement des rapports d'armement (qui passe fréquemment de 0,80 à 0,70 mailles ouvertes au carré).

### lignes à thon :

Un système mécanique de déhalage des lignes à thon a été mis au point. Les essais en mer d'une annexe ainsi équipée, effectués en 1975 n'ont pas été concluants, en particulier la

longueur du navire traîneur ne doit sans doute pas tomber au-dessous d'un chiffre minimum, ce qui pourrait s'expliquer par des phénomènes d'écoulement. L'annexe expérimentée au cours de la campagne 1975 mesurait moins de 12 m de longueur.

Par contre, les essais ont montré la possibilité d'accroître de manière substantielle le taux de prise en allongeant nettement les lignes de traîne et le bas de ligne en nylon. Le système de déhalage hydraulique rend possible une telle manoeuvre sans modification de l'ensemble du gréement.

### Sélectivité

Aucune expérience de sélectivité n'a été réalisée en 1975.

### Bassins d'essai - maquettes

Cette année a vu se terminer la construction d'un bassin d'essai de chaluts à Lorient. Ce bassin a été réalisé sur le même principe que celui de Boulogne-sur-Mer. Construit en béton, ses côtes intérieures sont :

largeur	2,60 m
hauteur d'eau	1,70 m
longueur pratique	14 m

La vitesse du courant d'eau peut atteindre 1,20 m/s. Les maquettes qui peuvent être essayées sont réalisées à des échelles comprises entre 1/10 et 1/30<sup>ème</sup>. Nous allons ainsi y tester très prochainement la maquette d'un chalut 4 faces à langoustine et celle d'un chalut pélagique à cordes.

Un programme de collaboration franco-soviétique dans le domaine des études d'engins et de comportement du poisson, élaboré en 1974 mais qui n'a pas pu être réalisé en 1975, devrait se traduire en 1976 par des essais en commun de maquette de différent types de chalut, à la fois en bassin et dans un lac - et par des observations sous-marines des engins grandeur nature à la mer.

### Bateaux de pêche - aménagements

Dans le domaine de la pêche industrielle, on a assisté en 1975 au développement des tambours enrouleurs, pour les chaluts pélagiques. Ce sont généralement des tambours de grande capacité entraînés par des moteurs puissants.

En ce qui concerne la pêche artisanale, les tambours sont généralement utilisés pour la manoeuvre des chaluts de fond. L'entraînement de ces tambours se fait soit par l'intermédiaire d'un cable, soit d'un moteur hydraulique.

Sur ce type de navire, les tuyères sont de plus en plus fréquemment implantées lors de la construction.

Signalons un développement de l'utilisation du sondeur de corde de dos par les bateaux de cette catégorie.

Il est à noter également, en Méditerranée, le développement de la construction plastique d'unités de 22 à 25 m, chalutiers ou senneurs.

### Pêche électrique

Les études entreprises à l'I.S.T.P.M. sur le comportement des poissons dans un champ électrique ont été réalisées jusqu'en 1974 soit dans des rigoles expérimentales, soit dans des bacs de dimension réduite et peu profonds. Les réactions de fuite qu'auraient pu manifester les poissons n'apparaissent donc pas avec netteté car elles étaient le plus souvent masquées ou perturbées par la proche présence des parois des différents bacs. De plus, les comportements étaient seulement observés dans des couches d'eau horizontales de faibles épaisseurs.

Afin de compléter ces observations pour déterminer quels sont les stimuli suffisamment coercitifs pour être utilisables dans un système de pêche par lumière, champ électrique et pompe, de nouvelles expériences ont été effectuées en 1975. Elles ont essentiellement porté sur des sardines, *Sardina pilchardus* (WALBAUM), de 13,5 cm de long. La puissance électrique du générateur dont nous disposions, ne nous a pas permis de travailler à une échelle suffisamment grande dans un volume d'eau de mer à trois dimensions. Nous avons donc d'abord opéré dans un "bac horizontal" avec une hauteur d'eau réduite (4 m x 2 m x 0,25 m) puis dans un "bac vertical" contenant une tranche d'eau relativement profonde, mais de faible largeur (3,50 m x 1,10 m x 0,25 m). Il a ainsi été possible de déterminer, en fonction de la fréquence et de la durée des impulsions, les gradients de potentiel nécessaires pour provoquer des taxies anodiques réellement coercitives.

En 1976, un projet de pêche par lumière, champ électrique et pompe devrait être proposé. Il reste seulement à déterminer sur une maquette, à partir des résultats obtenus en 1975, les caractéristiques à donner au système d'électrodes pour qu'il présente la meilleure efficacité possible.

## Acoustique

En 1975, 7 campagnes de cartographie acoustique ont été effectuées dans le Golfe de Gascogne. Les missions, orientées vers l'étude rationnelle de l'écologie et du comportement migratoire des poissons pélagiques côtiers (sardine, sprat, anchois et hareng) avaient également pour objectif la circonscription des zones de concentration. Pour ce faire, le navire a suivi une route en dents de scie, la prospection s'est effectuée grâce au sondeur vertical à ultra-son et toutes les données nécessaires à une exploitation rationnelle des bandes de sondeur ont été recueillies. A l'issue de chaque campagne, il a été établi des cartes qui schématisent la route suivie par le navire et les zones de concentration rencontrées et qui ont été diffusées auprès des organismes de professionnels intéressés.

L'identification a été réalisée à l'aide des chaluts pélagique ou semi-pélagique. Les nombreux coups de chaluts, effectués en 1975, ont permis une première approche des réactions des poissons face au chalut et des vitesses de traîne nécessaires pour capturer ces poissons pélagiques.

Au laboratoire, les différentes détections ont été étudiées plus en détail et l'exploitation, actuellement en cours, est orientée principalement vers l'identification des espèces à partir de la forme et du volume des bancs.

En 1976, 5 campagnes de cartographie dans le Golfe de Gascogne sont programmées. Dans le courant du 2<sup>ème</sup> semestre 1976, il est prévu d'équiper "La Pélagia" d'un ensemble acoustique d'évaluation des stocks. Au cours des mois de novembre et décembre, une première campagne d'évaluation quantitative des stocks de clupéidés du Golfe de Gascogne est programmée.

## German Democratic Republic

(H. J. Fischer)

A knotless, braided, polyamide netting was tried for bottom trawling on several stern trawlers throughout 1975. The good results regarding netting economy, net resistance and catching yield made it possible to recommend these materials for further industrial use. The investigations of this material concluded successfully.

Investigations for determining the selectivity of bottom trawls for demersal fish began in 1975. The codend was attached in a new way such that the codend cover was a certain distance from the codend and so did not influence the selectivity of the codend.



The studies for improving the methods for designing trawls will continue. Special investigations concerning the form of the trawl warps in relation to tension and extension and methods for investigating hydrodynamic coefficients of netting were carried out.

New constructions of trawl boards for midwater trawling on powerful stern trawlers were tested on research vessel and commercial fishing craft.

Investigations for improving the construction of bottom trawls for stern trawlers were carried out by using model nets in a wind tunnel and at sea by scuba divers.

#### Germany, Federal Republic

(H. Bohl)

In 1975, several types of rope trawl ("Tauwerk-Netze") for inshore and distant water fisheries were designed by the Institut für Fangtechnik. The necessary calculations were according to the catenary theory to assure uniform force distribution between the ropes substituting for the netting in the fore-net. These calculations are based on the dimensions of the net mouth measured during optimum-performance tests. This work included two-panel and four-panel nets.

A 200-ft-groundrope, high-opening, bottom trawl with an unusually short belly was successfully tested while fishing for saithe off the Shetland Islands. The trawl was operated with and without ponies, with different types of otter boards and with legs of different length.

Research on otter boards was continued by means of full-scale trials with a new board type (round, cambered). In addition, model wind-tunnel tests were performed with various types of otter boards (flat and rectangular, Polyvalent, Süberkrüb, V-shaped, round) to obtain the exact lift and drag coefficients.

Deep water trawling was again conducted with a specially designed, 200-ft, high-opening bottom trawl on the continental slope west of the British Isles. Rather good catches of grenadiers could be obtained, whereas tradeling, which were sought extensively, occurred only in small quantities. In the Gulf of Biscay a successful deep water fishery proved impossible due to crevices and steep slopes in that area and to the scarcity of fish in the deeper basins.

The relationship between cod distribution and water temperature was studied by means of a combined thermo-netsonde in the Barents Sea.

In continuation of a long-term series of model tests, various types of rope trawl and otter board of scale 1:4 were observed by means of a multi-netsonde and by skin-divers in the western Baltic. For these experiments, a cutter of 12-m total length and 100 h.p. was chartered.

Experiments with electrified beam trawls for catching flatfish were conducted aboard FRV *SOLEA* in the German Bight. The vessel was double-beam-rigged, and during each haul comparative fishing was performed between the electrified starboard trawl and the conventionally equipped port trawl. The pulses generated by condenser discharge were transmitted by cable to two pairs of electrodes mounted to the beam. The maximum of about 80 volts was applied between the electrodes and frequencies ranged from 10 to 40 Hz. The catches made with the electrified trawl were always bigger in quantity than those with the non-electrified one. In the case of sole it was also possible to catch more large-sized fish by means of the use of selected voltages and frequencies.

A research vessel cruise to the Azores was undertaken to develop gear techniques for catching euphausiids in preparation for the German 1975/76 Antarctic Expedition.

The development of a shipborn data acquisition system was continued in 1975. New components were tested to obtain data such as for speed, thrust, warp load and height and width of the net opening. The punched tapes were partially processed aboard a research vessel by a HP 2100 computer.

#### Net Materials

All midwater trawls and about 90% of the bottom trawls manufactured in the Federal Republic are made of polyamide. The remaining 10% of the bottom trawls are made of plaited polyethylene yarns.

Despite continually rising prices for net materials, the extra strong codend netting yarns (R 14 - 18 ktex) now prevail in bottom trawls.

The cooperation with national and international bodies concerned with net materials and standardisation of testing methods was continued.

Research was started to determine the cause(s) of the decreasing elasticity of midwater trawl netting yarns with use in fishing operations.

#### Selectivity Experiments

In accordance with C.Res. 1974/4:18, comparative selectivity experiments with a 140-ft, bottom trawl and a four-panel midwater trawl of 1000 meshes circumference at 40-cm mesh length were carried out in April 1975 in Subarea I. The data obtained do not show a difference between the cod selection

factors derived from the two types of trawls. In the case of haddock, however, the bottom trawl experiments resulted in a higher selection factor (3,49) than the midwater trawl experiments (3,06). A comparison of the length compositions of those catches which were made within a short period on the same fishing ground shows the bottom trawl to catch relatively more small-sized cod and haddock than the pelagic trawl.

Experiments carried out in November 1975 with FRV *SOLEA* in the Fehmarn Belt (Baltic) yielded a cod selection factor of 2,30 for a single-braided, bottom trawl, PA codend of 110-mm mesh opening. This factor is much lower than the factors found aboard Polish and German research vessels during the period 1972/74 (2,82 to 3,43).

The research program for 1976 includes selectivity experiments on redfish. Special attention will be paid to the problem of meshed fish.

#### Fish Behaviour, Noise Measurements

Fish reactions during trawling were observed by means of various echo sounding equipment during commercial and research cruises and by skin-divers during model tests with trawls in the Baltic.

Noise was measured while towing a midwater trawl of 1000 meshes circumference at 40-cm mesh opening. A high amplitude of vibrations at frequencies below 200 Hz was observed.

#### Iceland

(G. Thorsteinsson)

The experiments with selective prawn trawls were continued. In spite of good results regarding the conservation of undersized fish, this gear has not been accepted by the fishermen due to its complexity in use and repair. Therefore, trials with prawn trawls, with shorter wings, which possibly could reduce the catch of small fish, have been started. So far, results are inconclusive.

An experiment with bigger meshes in the prawn trawls was carried out off the northwest coast in August. It proved to be possible to increase the mesh opening from 36 to 40 mm without evident loss of prawn of commercial size.

The selectivity of bottom trawls on cod, haddock and redfish with polyethylene codends of 150-160 mm mesh opening was examined. Particular attention was paid to the net attachment. The results of these and former experiments will be used when making decisions regarding the minimum permissible mesh size in Icelandic waters.

### Materials in use

Danish seines and bottom trawls, including prawn and Nephrops trawls, are made of polyethylene. However, codends of white fish bottom trawls are to some extent constructed of a mixed twine of polyamide and polyethylene. Bottom trawls on Norway pout are polyamide. Midwater trawls are constructed of polyamide. However, some trials have been carried out with polyethylene. Purse seines are entirely made of polyamide. All gillnets are polyamide multi- and mono-filaments. Longlines are made of a mixed line of polyethylene and polyester.

### Ireland

(F. A. Gibson)

No report received.

### Netherlands

(E. J. de Boer and S. J. de Groot)

The performance of a trawler (freezer sterntrawler; 2700 h.p.) was measured during three trips to the fishing grounds in the Hebrides area. During the last two trips the data acquisition system, which measured 19 variables, worked satisfactorily. The measuring programme on board sterntrawlers is terminated because sufficient data are considered to be collected for future trawler design. A similar programme for small trawlers (multi-purpose) is being planned.

Experiments were started with a "rope-trawl" in order to decrease the resistance of midwater trawls. In this trawl the large meshes in the front part are replaced by ropes (Nymplex). In the first experiment the comparison of parameters of the rope trawl and a standard trawl of the same dimensions gave negative results. The prototype of the rope trawl has been redesigned and the experiments will be continued in January 1976. Because most Dutch sterntrawlers fish with the midwater trawl very close to or even on the sea bed the research is also directed towards the behaviour of the "rope-trawl" when fishing over a rough ground.

Experiments were carried out to improve the efficiency of bottom trawls when fishing for roundfish in the undulated area of the Southern North Sea. Two types of trawls were tested, a commercial four-panel bottom trawl with semi-pelagic rigging and a high-head line bottom trawl. To avoid damage to the groundrope a false groundrope was fitted 60 cm in front of the groundrope. The otterboards were of the Morgère-type (Polyvalent). After a number of improvements and adaptations, both gears could be fished in an area having "dunes" with a height up to 10 metres. Although the vertical net opening of the high-headline trawl was



better as expected, more fasteners occurred with this gear. Owing to lack of fish in the area, no comparison of catch efficiency could be made but comparative fishing is planned for next year.

A new pulse generator for a commercial-sized beam trawl to stimulate flatfish by means of electrical ticklers was designed and ordered. Owing to delay in the delivery and teething troubles during the first series of field tests, no positive results can be reported. The introduction of electric stimulation when fishing for flatfish species (beam trawl operation) is scheduled to start in March/April 1977 on board a commercial trawler.

The mechanical feeder for the rotating shrimp grader is now in commercial use on a number of shrimp vessels. It is a great labour-saving device and improves the efficiency of the grader. The catch per fishing day with the feeder increased very considerably owing to a twofold improvement in the accuracy of the selection, especially with large catches. Moreover, the discards are kept wet from the moment they come on board until they are washed overboard. Improved survival is expected, although this has not yet been studied scientifically.

A rotating shrimp grader for brown shrimps (*Crangon crangon*) was adapted to the fishery of *Pandalus* in the Farne Deep and Fladen Grounds but experiments showed that the capacity and the sieving efficiency of the converted rotary sieve was too low. The construction and the dimensions of the sieving cylinders will be adjusted.

The experiments to collect mussels from the sea bed by hydraulic dredging were continued. The main emphasis is to decrease the amount of sand and silt in the dredging process, to fish in stronger currents through improved stability of the dredging head, and to fish in greater depths (more than 6 m).

Experiments on cleansing internal sand and silt from mussels by pumping fresh seawater vertically through the layer of mussels while stored in a vessel have led to positive results. Experiments with circulating water were less successful. The mussels experienced a loss of moisture which is as yet unexplained. The experiments are being continued.

A joint research program was carried out with the River and Harbour Laboratory (V.H.L.) - Trondheim, Norway, on the influence of fishing gear on pipelines. Among the participants to these investigations were representatives of the Governments of Norway, U.K. and The Netherlands, as well as the major oil companies with interests in the North Sea. The influence and effects of trawl-doors and beam trawls upon a pipeline were studied in model as well as in full scale. There are several plans to continue this type of research.

No significant changes in the equipment used for plankton sampling occurred during the period.

Norway

(Steinar Olsen)

Basic studies of longlining for tusk and ling were carried out off the Møre banks in April/May. Catch rates were found to be less affected by number of hooks than by length of line, i.e. area of ground covered, and a twisted hook gave significantly higher catch rates than the flat hook normally used in Norwegian longline fisheries. These studies will be continued off North Norway in 1976.

The development of a system for mechanized longline baiting ashore to be used in the coastal fisheries is progressing, and prototype testing of the vessel components of the system were started towards the end of the year.

Work on artificial bait has also been pursued with laboratory and small field experiments to establish the most effective stimuli dosage and the best combination of solubility, consistency and other characteristics of the bait.

Initial trials with an hydraulically operated gill-net drum were very encouraging and further experiments to improve the mechanization in the Norwegian gill-net fisheries for bottom fish are planned for 1976.

Extensive trials with deep-sea traps were conducted at different times of the year and on different fishing grounds. Efficient operation of such gear is quite possible with conventional Norwegian coastal fishing vessels and commercial catch rates of tusk were obtained. Cod and other demersal species, however, were not taken in sufficient numbers to indicate prospects for commercial application. Plans for 1976 include full-scale commercial fishing trials for tusk and work on improving the efficiency of the traps for catching cod and similar fish.

As reported previously, selectivity experiments in the Barents Sea in March 1975 gave a similar selection factor for pelagic trawl as for bottom trawl, but the size distribution of fish (cod) at the bottom and in midwater was found to be quite different at the time and location of the experiments.

Work on separating and releasing fish from prawns in the prawn-trawl fisheries was continued and intensified. A netting panel mounted diagonally in the trawl belly gave good sorting at medium and low levels of fish density on the grounds and rectangular meshes in the sorting panel improved the sorting efficiency. This project is being continued in 1976 and a detailed study of the magnitude and time distribution of fish fry on the prawn grounds has been started. Similarly, a program investigating the behaviour of prawn and fish fry in relation to fishing gear has been initiated.

Trials with a pelagic trawl for blue whiting, in which the meshes of the front part were replaced by wire straps, were carried out in April/May. The results showed that wire straps are difficult to handle and to replace and this project is therefore being continued in 1976 using meshes of 2-m width in the front part of the trawl.

A four-panel trawl specially designed for catching krill has been developed and successfully tried for experimental fishing on research vessels.

Some preliminary experiments on cod were undertaken in the Barents Sea with acoustic tags to develop a method for direct measurement of fish migration speed. By surveying the area with a 120 kHz sonar, the tagged fish could be spotted for a period of more than a week. The experiments will be continued in 1976 off the Lofoten Islands.

The effect of dredging and other industrial activities at the entrance of a salmon river (Orkla) on salmon about to enter the river has been investigated by use of acoustic tags. The results indicated that although the fish seem to meet some difficulties at the river entrance, they still manage to pass.

The acoustic tag system available in Norway now offers various possibilities for behaviour studies of free swimming fish. An advanced system for very precise tracking (the "Pin Point" system) is completed and several tags giving information about heartbeat, tailbeat, depth of movement or temperature are now available.

Experiments storing live fish in small fjordinlets have been continued. This year 250 tons of saithe were stored for a period of four months without any reduction in fish quality. For recapturing, a method of sound/food conditioning and trapping of the fish was tried in parallel with conventional purse seining.

Some theoretical work has been done to develop mathematical models describing fish behaviour in terms both of interactions between the fish and environmental influences and of the momentary sensitivity of the fish to these influences. This latter is regarded as a function of the biological condition in a fish. Continuation of this work is being considered in relation to various aspects of modelling marine ecosystems.

Trawl codends in Norway are practically all made of nylon; for other parts of the net, polyethylene is also used.

Poland  
(W. Ciegiewicz)

See Addendum.

Portugal

(Manuel Lima Dias)

The Institute of Marine Biology has started some pelagic trawl experiments on the coastal research vessel *MESTRE COSTEIRO*. During a trip to Norway, this vessel suffered some damage, and is still not completely operative, so that special research could not be conducted. Pelagic experiments so far have been restricted to short coastal cruises.

Spain

(Rafael Robles)

The Institute of Fisheries Research has used ultra acoustics for the assessment of benthic organisms, particularly in relation to non-uniform distribution of fish off northwest Africa. The distribution of pelagic organisms (*Sardina pilchardus* Walb.) in the same area were studied, particularly in relation to geographic extent and diurnal rhythms. Mathematical models of the spatial distribution of shoals were developed from measured responses.

The reactions of various species (*Sparus aurata*, *Dicentrarchus labrax*, *Mugil auratus*) during larval growth and in early life stages to varying conditions of food availability, temperature, salinity and light were studied.

Sweden

(G. Otterlind)

No special activity is reported and no major changes in gear construction and netting material are noted.

United Kingdom

1. England (A. R. Margetts)

The comparative fishing experiment using the sector-scanning sonar and acoustic transponding fish tags to measure the catching efficiency of the Granton trawl on plaice was completed and a detailed study commenced on film records from that experiment of the responses of fish to the gear, in particular those fish between the otter boards and net wing ends.

The technique of the trawl efficiency experiment was used for preliminary measurements of the effect on trawl catches of the use of a tickler chain rigged between otter boards.



Studies on the migratory behaviour of fish were continued. A comparative fishing experiment using pelagic trawls to catch plaice swimming off the bottom demonstrated a selective tidal transport mechanism in the spawning migration of plaice in the southern North Sea. Experiments with acoustically tagged cod and the sector-scanning sonar indicated that cod also used a selective tidal transport mechanism.

The hydrodynamics of plaice were studied in detail, with measurements being made in a flume tank, particularly to interpret behaviour on the bottom in tidal currents; the thickness:length ratio of plaice was shown to give the minimum drag coefficient for a semi-ellipsoid body resting on a flat surface.

Some progress was made with the technique of implanting electrodes in a plaice for the telemetering of physiological data via a special acoustic tag.

Considerable effort was devolved to acoustic estimation of fish abundance and in particular to the determination of equipment stability and its calibration. Major surveys were made of blue whiting stocks to the west of Britain, of mackerel off southwest England, and of 0-group pelagic fish in the Barents Sea. In the method of echo integration the signal processing error was found to be insignificant, so the target strength of the surveyed fish species is the most important factor in improving biomass estimation. The towed body transducer was modified to retain its efficiency to 300-m depth, a pressure-tight tuning box being fitted at the end of the long towing cable; the purpose of this is to enable the transducer to be towed just above the layer of fish, so reducing the volume sampled by the echo-sounder.

The White Fish Authority Industrial Development Unit based at Hull operates throughout the United Kingdom and not just in England but, as the UK Administrative Report would not be complete without it, a record of WFA activity in fishing gear development, provided by Mr. J. F. Foster, is included here:

A flume tank has been built at Hull for the investigation of fishing gear, especially trawls. This facility was designed on the same principles as the installation at Boulogne sur Mer but is larger. The dimensions of the tank are:

Length of a	31 m
Width	5 m
Water depth in working section	2.5 m
Length of working section	11 m
Length of bottom conveyor belt	11.2 m
Width of bottom conveyor belt	5.0 m
Maximum water speed	1.5 m/s

A first exploratory fishing voyage for squid off Rockall, using a Japanese squid jigging system, was carried out. For various reasons this was not completely successful but the work is to be continued.

A detachable longline snood system was developed for vessels of length less than 24 m; first trials showed it to be quite successful and commercial evaluation is planned.

Performance trials of a purse-seiner were carried out to determine the power required in carrying out the various purse-seine fishing operations and to measure the loads imposed on the vessel by the fishing gear. These included free-running, thruster and fishing trials.

Development commenced of a portable instrumentation package for measuring trawl spread and headline height which might be used by a small field party to make measurements during normal commercial fishing operations. The system is based on use of a cable winch.

## 2. Scotland (J. J. Foster)

No report received.

## U.S.A.

(Glade Woods and Keith Smith)

Underwater television camera observations were made from the Research Vessel *GEORGE M. BOWERS* on lobster traps in a natural marine environment off the Dry Tortugas. Small tropical fishes quickly moved into and around the trap. Sea urchins were seen rapidly moving towards the trap in response to the bait.

Repackaging and documentation of the Remote Underwater Fisheries Assessment System (RUFAS), model II, was initiated to improve the reliability and maintainability.

Four evaluation cruises were conducted to determine the design criteria for a prototype shrimp separator trawl for the U.S. Southeast Region. Six separator panel designs were evaluated and five secondary escape devices were tested. Optimum results were obtained employing a rectangular V-panel separator panel with 1 1/4-inch by 2 1/2-inch mesh size which separated 62% of the fish species while maintaining 87% shrimp capture rate compared to a standard shrimp trawl.

The field operations for a 22-month investigation have been conducted cooperatively by private industry, Federal and State agencies to demonstrate the feasibility of using Satellite (LANDSAT) data for enhancing the management and utilization of coastal fishery resources in the Northern Gulf of Mexico. Menhaden (*Brevoortia patronus*) and thread herring (*Opisthonema oglinum*) were selected as target species in the study areas located in the Mississippi Sound and off the Louisiana coast.

Three main-mission days were planned for each test area. Main-mission days include satellite and aircraft remote sensing coverage, oil platform oceanographic sea truth and vessel coverage, fishery industry spotter aircraft, and fishing vessel data acquisition. Synoptic sea truth data were obtained from remote sensing aircraft and satellites. This investigation is expected to produce a valuable source of information to augment our knowledge of the coastal water ecology and provide new remote sensing and data management techniques.

An investigation was conducted near Bimini concerning the location, identification, and counting of the Atlantic bluefin tuna using aerial photography techniques. Tests were conducted to make the best film selection for the operation prior to the survey. The survey approach did prove feasible as a number of large fish were located, identified, and sized.

A cooperative experimental hydroacoustic survey was carried out in ICNAF Subareas 5 and 6 during March and April 1975. The lead hydroacoustic survey vessel was the USSR R/V *POISK*, followed by the USA R/V *DELAWARE II*. Sampling of sounded schools was conducted by the Polish R/V *WIECZNO* and by the GDR R/V *ERNST HAECKEL*. Data sufficient for use in fisheries stock assessment were not acquired but several objectives of the experiment were achieved, particularly precise recordings of "raw" echo signals from fish concentrations for analysis. A preliminary report on this work is available.

#### U.S.S.R.

(A. I. Treschev)

The problem of extension of trawl-net materials under different loads was studied in the laboratory and at sea. Investigations to improve fishing gears and methods for measuring fishing power and fishing effort were continued.

Behaviour of fishes was studied during cruises of R/V *PERSEUS-III*, *ODYSSEUS*, *ARTEMIDA*, *TUNETs* in the northern Atlantic. Cod, rock grenadier, Greenland halibut and capelin were the objects of these investigations. Observations were continued with the help of hydrostate *SEVER-I*, photocamera *TRITON* and hydroacoustic fish detecting devices of Soviet and Norwegian manufacture.

Visual observations on rock grenadier under natural conditions were conducted for the first time.

New data on catchability of cod by a trawl were obtained.

Influence of diurnal peculiarities of capelin behaviour upon their availability for the abundance assessments with the acoustic instruments was investigated.

Investigations of selectivity of bottom-trawl codends used in cod fishery were continued in the Baltic Sea. Capron codends of 80-90 mm mesh size made of yarns of different thicknesses were tested. Selectivity of bottom-trawl codends of 80 mm mesh size was tested in fishing for river flounder. Empirical relationships between the non-commercial by-catch and the age composition of the fished cod populations were revealed.

Investigations of the selectivity of the front sections of herring trawls were continued. Tests on the survival rates of sprat escaping through the mesh of the codend were started.

In 1976, investigations in all aspects will be continued.

In 1975, fishing gears used in all types of marine fisheries were made of polyamide Capron fibres.



Poland

(Franciszek Bucki)

Investigations were continued in the Baltic Sea on the selectivity of cod trawls. Four cod-ends, made of Polish PA (Stylon) yarn, 3,0 mm thick, with 80, 90 and 100 mm nominal mesh openings (as measured by the ICES gauge) were tested. The 80- and 100-mm mesh-opening netting was made by machine and finished with polyamide and polyurethane, whereas the 90-mm netting was knitted by hand and was not finished. Selectivity coefficients were between 3,36 and 3,88. Special attention was paid to changes in mesh opening during fishing operation. The netting finished with polyurethane experienced the least change. These tests established that the mesh size of netting made in Poland and used in cod trawls complies with the rules of the Baltic Sea Convention.

Also, initial tests were conducted in the cod fishery using trawl cod-ends with rectangular meshes made of polyamide "ribbon" 10,0 mm wide by 1,5 mm thick. Two mesh sizes were tried, with inside dimensions 65 mm high by 35 mm wide and 80 mm high by 40 mm wide, respectively. Selectivity coefficients were between 4,61 and 4,65 respectively. These tests will be continued in 1976.

A specification was drafted for a standard method for measuring mesh size for use in inspections on fishing vessels in zones of international fishery conventions. This draft was submitted to the ICSEAF meeting in Madrid in December 1975.

Also, trials were conducted to improve the bottom and mid-water trawls used in the commercial fisheries.



The research programme of the Marine Laboratory, Aberdeen, of interest to the Gear and Behaviour Committee is covered by the numerous papers presented at the Committee's Working Group Meetings (April 1976) and at the 64th Statutory Meeting.

The main areas of work can be summarised as follows:

1. Further research and development of high opening for panel bottom trawls. Observation of gear by divers and underwater film and television techniques have proved extremely valuable. Considerable success with these gears in commercial fishing has been achieved.
2. Pelagic and semi-pelagic trawling studies have been continued with special attention paid to designing gears for operation near to the seabed without high risk of damage and remote control of otterboards.
3. Shipboard computing and data logging systems have been used for gear technology studies. The scope of the data logging and processing system is being extended to allow for results from smaller vessels (without a computer) to be added to the data bank.
4. Electric fishing work included further study of the response of flat fish to electric fields. Comparative fishing experiments with an electrified beam trawl showed that the electrified trawl without a tickler chain was as effective as a conventional trawl with a chain and caught fewer small fish.
5. Behaviour studies concerning sensitivity of fish to acoustic and visual stimuli and their swimming capabilities and performance were continued.
6. Work was started on the response of fish to various baits used in long lining. The effectiveness of artificial and natural baits together with different work design is being studied using low light television equipment for both sea loch and open sea experiments.

Engineering developments on remotely controlled instrumented underwater vehicles carried out by the Heriot-Watt University in Scotland are promising. Such a vehicle, called ANGUS has been demonstrated under open sea conditions operated from a research vessel. Further work on electronic fish tags is being carried out for special applications at other Universities, particularly at the University of Sterling.

